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(71) Applicant
Samsung Electronics Co. Ltd.

(Incorporated in the Republic of Korea)

416 Maetan-dong, Suwon, Kyungki-do,
Republic of Korea

(72) Inventor
Woon-Hee Na

(74) Agent and/or Address for Service
Venner Shipley & Co
20 Little Britain, London, EC1A 7DH,
United Kingdom

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(56) Documents cited
EP 0179530 A1 US 4677389 A

(58) Field of search
UK CL (Edition K) H3G GSE
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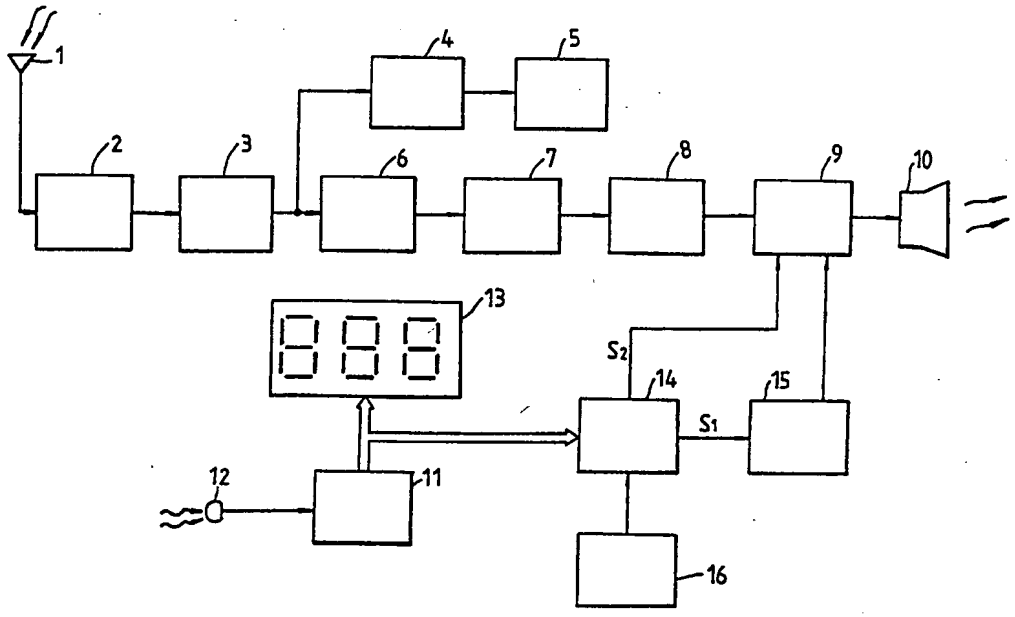
(54) **Sound volume control in response to ambient noises and display of noise level**

(57) The sound volume of sound producing apparatus is automatically controlled as a function of background noise. The device comprises background noise detecting means (11) for generating a driving signal; means (14) for generating a pulse width modulated control signal S1 corresponding to the driving signals; and means (15) for controlling the audio signal in accordance with said control signal, thereby providing the most suitable sound volume according to the background noise, avoiding the need for a volume switch (16) to be manually operated. Noise level may be displayed on panel 13. The control may be time-delayed.

FIG. 1



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Document Listing

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FIG. 1

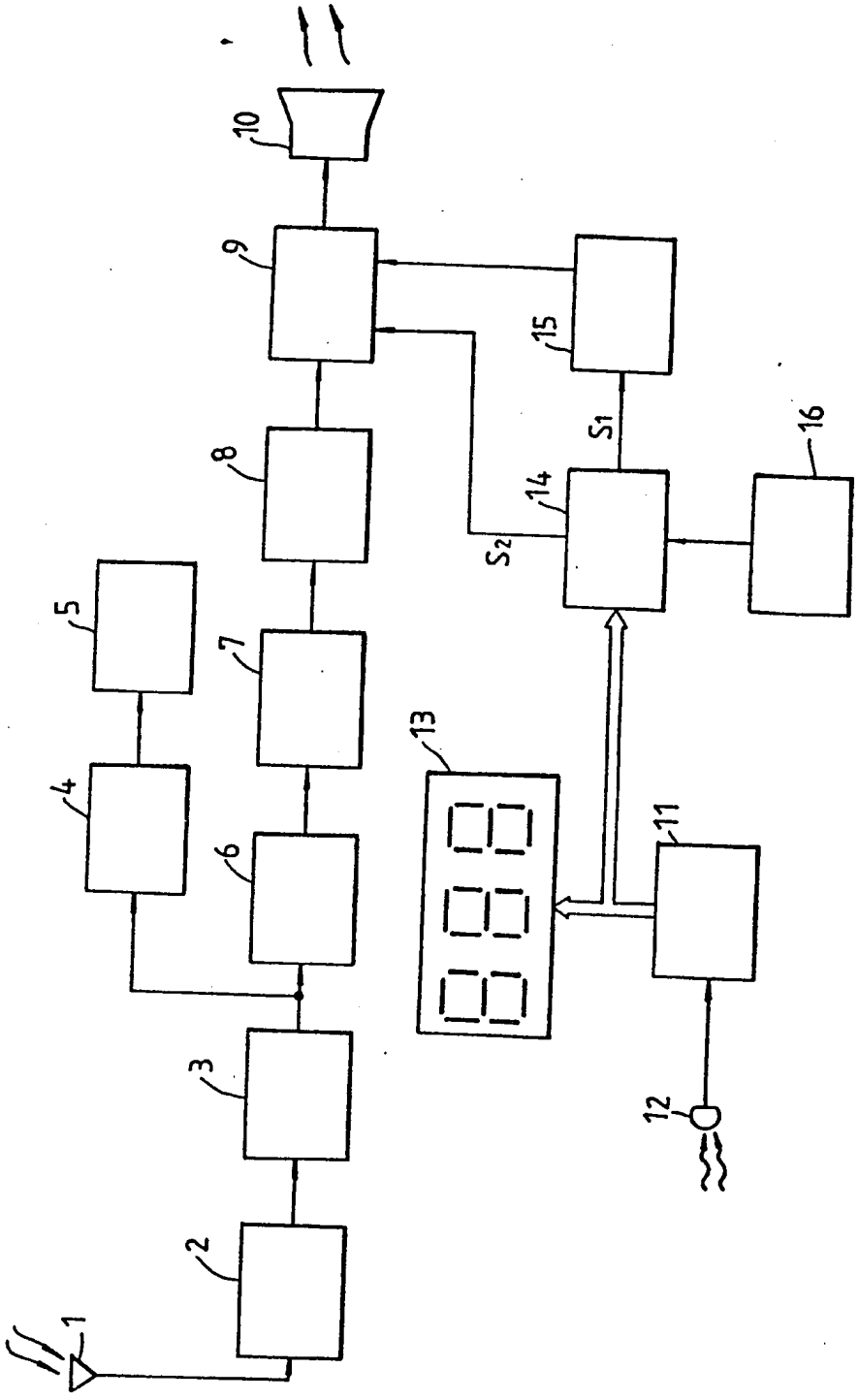


FIG. 2

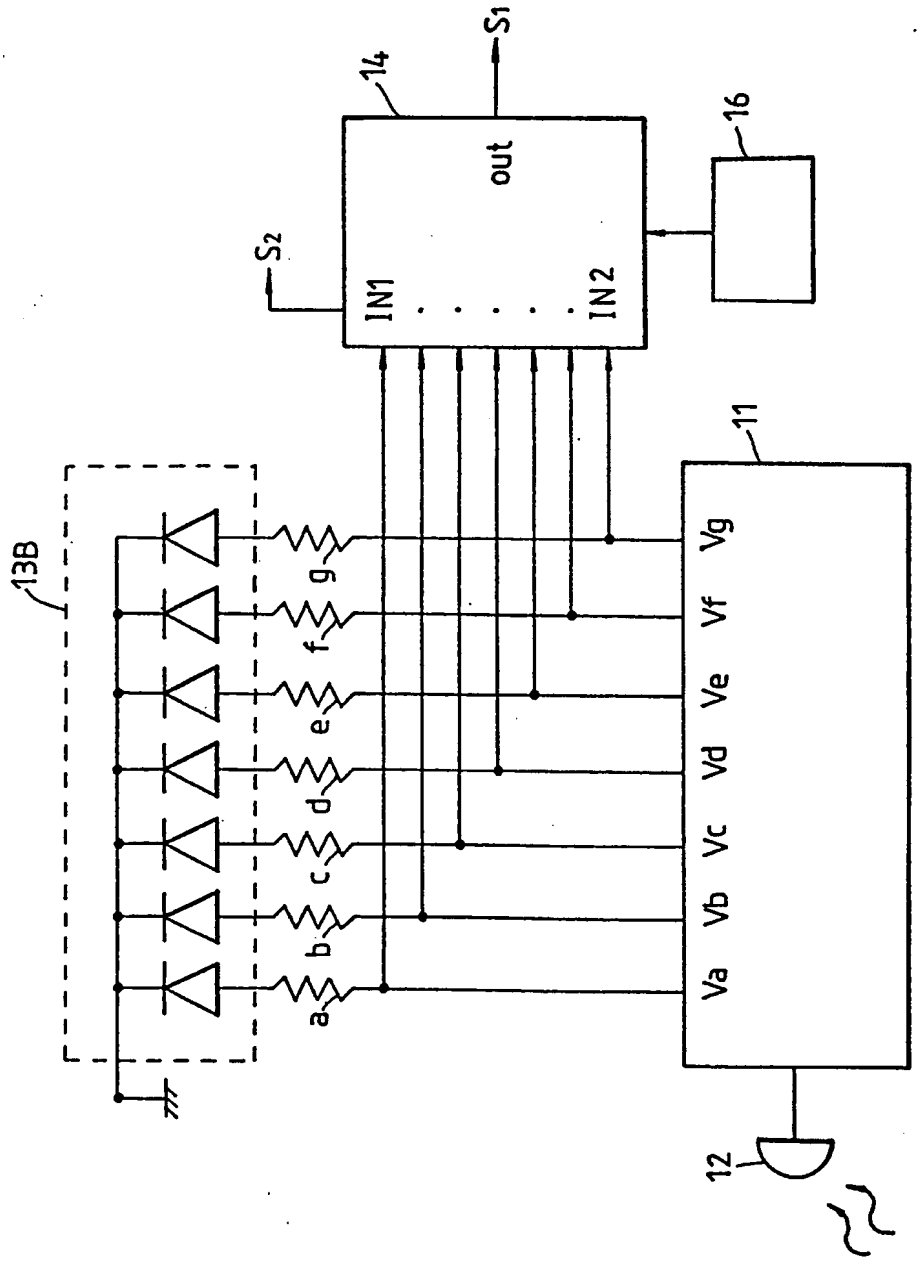


FIG. 3

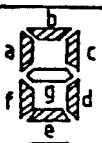
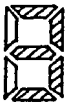
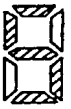
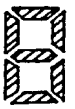
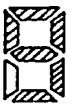
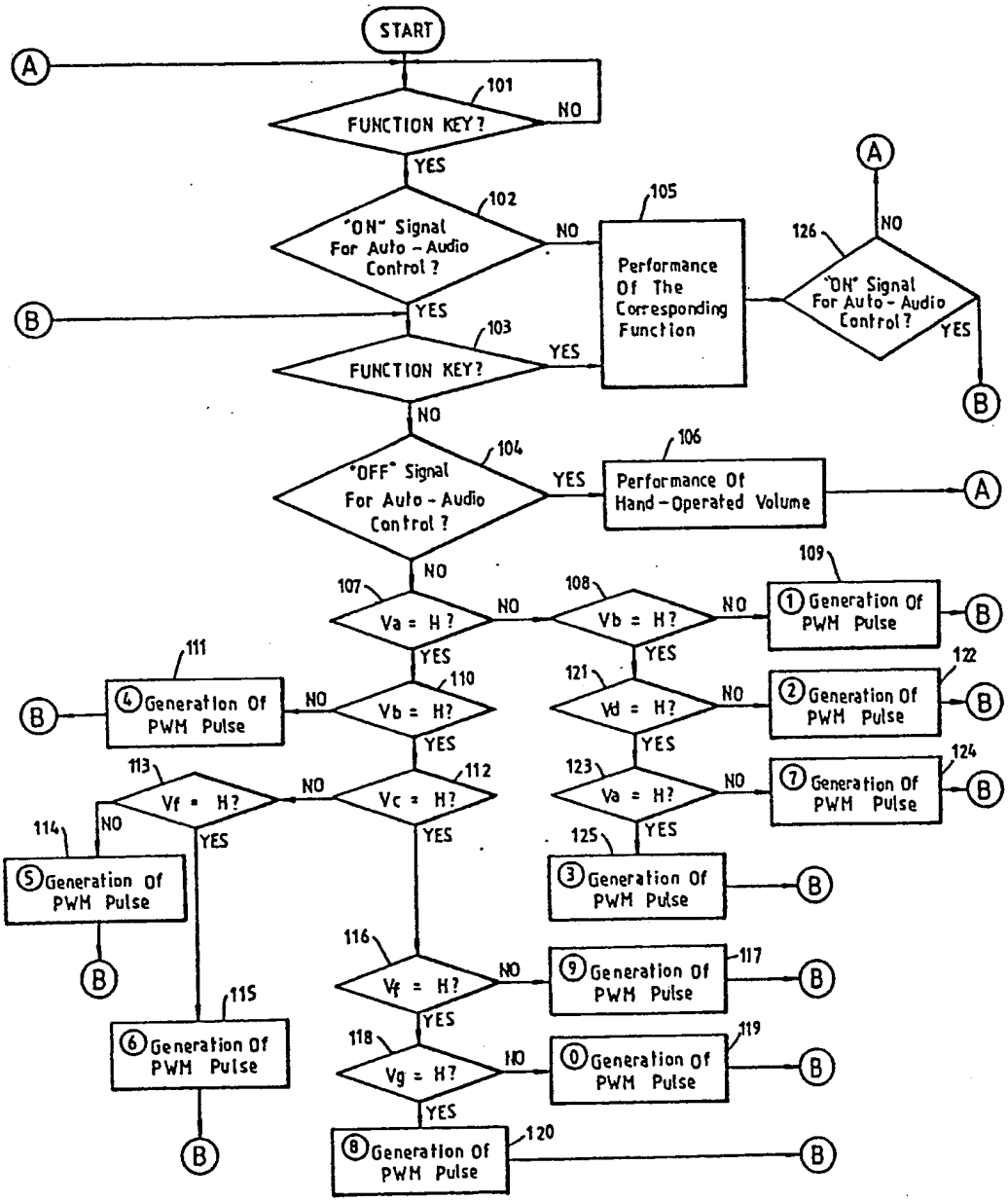
Number Displayed	Voltage For 7 — Segment						
	Va	Vb	Vc	Vd	Ve	Vf	Vg
	H	H	H	H	H	H	L
	L	L	H	H	L	L	L
	L	H	H	L	H	H	H
	L	H	H	H	H	L	H
	H	L	H	H	L	L	H
	H	H	L	H	H	L	H
	H	H	L	H	H	H	H
	L	H	H	H	L	L	L
	H	H	H	H	H	H	H
	H	H	H	H	H	L	H

FIG. 4


START
A
101
FUNCTION KEY?
NO
YES
102
"ON" Signal For Auto-Audio Control?
NO
105
Performance Of The Corresponding Function
126
"ON" Signal For Auto-Audio Control?
YES
B
YES
103
FUNCTION KEY?
YES
NO
104
"OFF" Signal For Auto-Audio Control?
YES
106
Performance Of Hand-Operated Volume
NO
107
Va = H?
NO
108
Vb = H?
NO
109
① Generation Of PWM Pulse
YES
YES
111
④ Generation Of PWM Pulse
NO
110
Vb = H?
121
Vd = H?
NO
122
② Generation Of PWM Pulse
YES
YES
113
Vf = H?
NO
112
Vc = H?
123
Va = H?
NO
124
⑦ Generation Of PWM Pulse
NO
YES
YES
114
⑤ Generation Of PWM Pulse
125
③ Generation Of PWM Pulse
116
Vf = H?
NO
117
⑨ Generation Of PWM Pulse
115
⑥ Generation Of PWM Pulse
YES
118
Vg = H?
NO
119
⓪ Generation Of PWM Pulse
YES
120
⑧ Generation Of PWM Pulse

AUTOMATIC SOUND VOLUME CONTROL DEVICE

DESCRIPTION

The present invention relates to a sound volume control device whereby sound volume of a sound producing apparatus is automatically controlled as a function of background noise.

Generally, most users of sound producing apparatus, for example, televisions, cassette tape recorders, radios, etc., use them in the manner that the sound level is manually controlled at a low level in the quiet of the night-time and at a high level in the noise of the daytime.

In conventional sound producing apparatus, sound volume is varied by manually operating a sound volume switch for controlling the gain of a variable gain amplifier. This is disadvantageous because users often have to

operate the volume switch by means of a remote or key operated controller.

The present invention resolves the above drawback.

According to the present invention, there is provided an automatic sound control volume device for sound producing apparatus, comprising: background noise detecting means to generate a driving signal; means for generating a control signal in dependence on the driving signal; and means for controlling the amplitude of an audio signal in dependance on the control signal.

Preferably, the control signal is a pulse width modulated signal. A control voltage level may then be generated by integrating the control signal.

Conveniently, the driving signal is a signal suitable for driving a 7-segment display.

Preferably, the driving signals are those for driving the tens-position of a multidigit 7-segment display.

Preferably, there is a delay between detection of a change in noise level and a resultant change in volume.

An embodiment of the present invention will now be described, by way of example, with reference to the drawings, in which:

Figure 1 is a block diagram of an automatic sound volume control device according to the present invention;

Figure 2 is a detailed diagram illustrating features that a microcomputer recognizes as noise level from driving signals which drive a 7-segment display in accordance with background noise detected by a noise detecting means;

Figure 3 is a table showing driving signals for driving the 7-segments of the tens position of a multidigit 7-segment display; and

Figure 4 is a flow chart illustrating the operation of the present invention.

Referring to Figure 1, a television broadcasting signal, which is received through antenna 1, is mixed with a local oscillator signal by super-heterodyning in the tuner 2, thereby converting the broadcast signal into an intermediate frequency signal. The intermediate frequency signal is then provided to an intermediate frequency amplifier 3. A video signal output from the intermediate frequency amplifier 3 is displayed on a monitor 5 via video processor 4. An audio signal output from the intermediate frequency amplifier 3 is provided to a sound detecting circuit 6. The output of the sound detecting circuit 6 is amplified by a sound intermediate frequency amplifier 7 and output through a speaker 10 via a FM detector 7 and a variable gain amplifier (low frquency amplifier) 9. Since these are well known technologies in colour

television or FM receiving devices, more detailed description will be omitted.

Noise detector 11 detects background noise through external microphone 12, and provides driving signals for displaying noise level on a multidigit 7-segment display 13 in dependance on the volume of the detected background noise.

The microcomputer 14 recognizes signals being provided from the noise detector 11 to the 7-segments of the tens-position of the display 13, and at the same time generates and provides a pulse width modulation signal S1 to a control voltage generator 15. The control voltage generator 15 integrates the pulse width modulation signal, and provides a voltage signal corresponding to the integrated pulse width modulation signal to a variable gain amplifier 9.

Thus, the sound volume through the speaker 10 is automatically controlled in accordance with the volume of background noise. The signal S2, provided from the microcomputer 14 to the variable gain amplifier 9, is a

signal for use in manually controlling the gain of the amplifier 9, which is generated in response to an input signal from a key-matrix 16.

Referring to Figure 2, numeral 13B shows the 7-segments of the tens-position of the display 13 as shown in Figure 1. The 7-segments are composed of seven light emmitting diodes, each of which may be selectively activated. The reason why this embodiment uses signals provided only to the 7-segments of the tens-position is that the noise level in a room is generally within several tens of dB. If the detected noise level is more than 100 dB or less than 10 dB, the presently set sound volume is output, that is, the microcomputer 14 is not activated.

The microcomputer 14 checks whether or not an automatic sound volume control signal is input via the key-matrix 16. In the case that an automatic sound volume control signal is input, the microcomputer 14 controls an audio level by controlling the gain of the variable gain amplifier 9, making use of signals for driving the 7-segments of the tens-position of the display 14 in

response to the level of the background noise. Otherwise, the sound volume is manually controlled by a remote controller or the key-matrix 16.

Referring to Figure 3, each of the 7-segments is invested with an identity from a to g for the purpose of making it easy to explain. Each of the 7-segments is ON when supplied a high level signal from the noise detector 11 and is OFF when supplied a low level signal. Therefore, the 7-segments display numerals 0 to 9 according to the combination of signals being provided.

For example, if high level signals are provided to segments a to f and a low level signal is provided to segment g, the display 13 displays arabic numeral 0.

Referring to Figure 4, the microcomputer 14 checks whether any function key signal has been input via the key-matrix 16 (step 101), and goes to step 102 upon detecting any function key signal. The microcomputer 14 also checks at step 102 whether the input function key signal is an ON signal for automatic audio control.

In the case that the input signal is not the ON for automatic audio control, after performing the corresponding function at step 105 the microcomputer 14 goes back to step 101 via step 126. At step 102, in the case that the input signal is the ON signal for automatic audio control, the microprocessor 14 proceeds to step 103 and also detects whether any function key signal has been input.

If there is any function key signal, the microcomputer 14 proceeds to step 105, performs the corresponding function, and further proceeds to step 126. At step 126 the microcomputer 14 also checks whether the ON signal for automatic audio control is still maintained. If it is, the microcomputer 14 proceeds to step 103; otherwise, back to 101. Again, at step 103, if there is no function key signal, it goes to step 104 at which it checks to determine whether an OFF signal for automatic audio control has been input. If the OFF signal is input, it proceeds to step 106 at which the sound volume is manually controlled and back to 101. If there is no OFF signal at step 104, the microcomputer 14 proceeds to step 107, and recognizes

the driving signal provided from noise detector 11 to the display 13 so as to control the gain of variable gain amplifier 9.

The microcomputer 14 generates and provides a pulse width modulation signal, which is variable according to the state of the detected driving signals Va to Vg for driving the 7-segments of the tens-position of the display 13, to the control voltage generator 15. Details will be explained below with reference to Figure 4.

At step 107, if voltage Va for driving segment a is low (L), the microcomputer 14 proceeds to step 108. In the case that voltage Vb is also low at step 108, the microcomputer 14 recognizes that the present noise level is 10 dB up to 20 dB, and generates therefore a first pulse width modulation (PWM) signal (step 109). Since the driving voltages Va and Vb, for driving the 7-segments, are both low when numeral 1 is displayed on the tens-position of the display the microcomputer 14 recognizes that the present noise level is 10 dB up to 20 dB.

Back to step 107, if voltage Va is H, the microcomputer 14 proceeds to step 110. At step 110 the microcomputer 14 goes to step 111 upon detecting that voltage Vb is L, numeral 4 being displayed on the display 13B.

Accordingly, the microcomputer 14 recognizes the present noise level as 40 dB up to 50 dB, and generates a second PWM signal (step 111). However, at step 110 if voltage Vb is H, the microcomputer 14 proceeds to step 112 and checks that state of voltage Vc. If voltage Vc is L, then it proceeds to step 113, and the state of voltage Vf is checked.

At step 113, if voltage Vf is L, the microcomputer 14 recognizes that the present noise level is 50 dB up to 60, while the detected voltages for driving the 7-segments result in the displayed numeral being 5. Therefore, the microcomputer 14 generates a third PWM signal (step 114), and then goes back to step 103. On the other hand, if voltage Vf is H, the microcomputer 14 recognizes that the present noise level is 60 dB up to 70 dB, while the detected voltages for driving the 7-segments result in the displayed numeral being 6.

Accordingly, the microcomputer 14 generates a fourth PWM signal (step 115), and then goes back to step 103.

Back to step 112, if voltage Vc is H, the microcomputer 15 proceeds to step 116. When voltages Va, Bv and Vc are all high, numerals 0, 8 nd 9 are displayed. Also, since voltages Vd and Ve for displaying the numerals 0, 8 and 9 are all high, there is no need, at this step, to check voltages Vd and Ve. Therefore, at step 116 the microcomputer 14 checks voltage Vf. If voltage Vf is L, the microcomputer 14 recognizes that the present noise level is more than 90 dB, and therefore generates a fifth PWM signal (step 117), and then goes back to step 103. Otherwise, the microcomputer 14 proceeds to step 118 and checks voltage Vg. At step 118, if voltage Vg is L, the microcomputer 14 recognizes that the present noise level is less than 10 dB and generates a sixth PWM signal (step 119), and then return back to step 103; if voltage Vg is H (that is, voltages Va, Vb, Vc, Vd, Ve, Vf and Vg are all high), the microcomputer 14 recognizes that the present noise level is 80 dB up to 90 dB and therefore generates a seventh PWM signal, and then return back to step 103.

Now, in the case that the voltage Vb is H at step 108 (that is, Va = L, Vb = H), the microcomputer 14 goes to step 121. Here, when voltage Va is L and voltage Vb is H, numerals 2, 3 and 7, as can be seen from Figure 3, are displayed. Also, since the voltage Vc for displaying the numerals 2, 3 and 7 is H, it need not check voltage Vc. Therefore, voltage Vd is checked at step 121. If voltage Vd is L (that is, Va = L, Vb = H and Vd = L), the microcomputer 14 recognizes that the present noise level is 20 dB up to 30 dB and, therefore, generates an eighth PWM signal corresponding to the detected noise level (step 122), and then returns to step 103; if voltage Vd is H, the microcomputer 14 proceeds to step 123.

If the voltage Ve is L at step 123 (Va = L, Vb=Vc=Vd= H, Ve = L), numeral 7 is displayed on the display 13B, and the microcomputer 14 recognizes that the present noise level is 70 dB up to 80 dB, and accordingly generates a ninth PWM signal (step 124), and then goes back to step 103. If voltage Ve is H, the microcomputer 14 recognizes that the present noise level is 30 dB up to 40 DB, and, therefore, generates a

tenth PWM signal (step 125), and then returns to step 103.

As described above, according to the present invention, since the microcomputer 14 detects the level of background noise by means of recognizing signals which also drive the 7-segments of the tens-position of the display 13, which displays the level of background noise measured by a noise detector, and provides a PWM signal, corresponding to the detected noise level, to a control voltage generator 15, and further since the control voltage generator 15 controls the gain of a variable gain amplifier 9 in response to the PWM signals, the output sound volume is automatically varied according to the level of the background noise, thus resolving inconvenience to users due to the need for manual control of the sound volume.

CLAIMS

1. An automatic sound control volume device for sound producing apparatus, comprising:
background noise detecting means to generate a driving signal;
means for generating a control signal in dependence on the driving signal; and
means for controlling the amplitude of an audio signal in dependance on the control signal.

2. A device according to claim 1, wherein the control signal generating means includes means for generating a pulse signal, width modulated in dependance on the driving signal, and control voltage generating means for generating a voltage level in dependance on the width modulation of the pulse signal.

3. A device according to claim 1 or 2, wherein the driving signal is suitable for driving a 7-segment display.

4. A device according to claim 3, wherein the 7-segment display includes at least two digits and the control signal generating means generates a control signal in dependance on the driving signal driving the tens position of the 7-segment display.

5. A device according to claim 2, wherein the control voltage generating means is an integrator.

6. A device according to any preceding claim, further comprising delay means for varying the volume of the audio signal after the lapse of a predetermined time from detecting a noise level.

7. An automatic sound volume control device, for sound producing apparatus, substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

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Relevant Technical fields

(i) UK Cl (Edition K) H3G(GSE)

(ii) Int Cl (Edition 5) H03G 3/20,3/24,3/32

Search Examiner
D MIDGLEY

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
9 OCTOBER 1992

Documents considered relevant following a search in respect of claims 1

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X,&	EP A1 0179530 (PHILIPS) whole document	1,2
X,&	US 4677389 (PHILIPS) whole document	1,2

Category	Identity of document and relevant passages	Rele .t to claim(s)

Categories of documents

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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